John Mulder

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PROJECT

Scolytus stain of white fir.

OBJECT

To study the possible relation this stain may have to the life history of Scolytus ventralis beetles.

HISTORY

For a number of years it has been observed that successful attacks in white fir by the engraver beetle Scolytus ventralis have been accompanied by a characteristic staining of the wood in conjunction with the insect galleries. No clue to the cause of the stain was known until 1930 when C. R. Struble, of the Division of Forest Insect Investigations, isolated a fungus organism from several specimens of stained wood. This organism when inoculated into living white firs produced a stain similar to that found in natural association with the beetle galleries.

In 1931 the Division of Forest Insect Investigations invited us to cooperate on this problem to the extent of making further studies of the causal fungus, giving special emphasis to its relation to beetle development. The investigation has been carried on by Wright. Field work was done in the immediate vicinity of the Stanislaus Branch of the California Forest Experiment Station. Laboratory work has been conducted at our own headquarters at San Francisco and at the

headquarters of the Division of Forest Insect Investigations in Berkeley.

ACTIVITIES AND RESULTS FOR 1932

To date the following results have been obtained.

1. Verification of Struble's findings.

2. Tentative identification of the staining organism as Trichoderma sp. Cultures have been forwarded to Dr. Richards at Madison for further examination. The name Trichoderma will be used hereafter in this report to designate the causal organism.

3. The stain has been found in constant association with Scolytus ventralis galleries. There is, however, considerable variation in intensity.

4. The fungus develops in the cambial region causing a brown discoloration of the new wood and inner bark. Mycelium has been found in the wood where it was observed to produce conidiospores in the tracheids, but it has not as yet been traced in the bark.

5. Following Koch's rules, the organism was re-isolated from formerly artificially inoculated white firs. Cultures of these re-isolations were later inoculated into other firs. These have not yet been reexamined. The organism has also been re-isolated from nine inoculations made by Struble in 1930. In ninety per cent of Struble's inoculations which were examined, the 1931 wood had completely covered over the stained areas, yet the staining organism

was alive in all but one case. In this one case the 1931 wood had not completely overgrown the stain.

6. An attempt to force adult beetles to attack a caged inoculated tree failed. The failure may be explained in part by the fact that there was a heavy flow of balsam from the inoculation wounds. Entomologists have found since then, that balsam is extremely toxic to adult beetles.

7. White fir balsam is not toxic to the Trichoderma although it does not alone provide a suitable substratum for growth.

8. Several isolations of the causal fungus have been made from living, newly emerged beetles.

9. Twelve dissected alimentary tracts(1 of larvae have shown Trichoderma to be present in ~~approximately~~ ten of the cases.

10. Ten externally sterilized whole larvae have shown the causal staining organism to be present in three of the cases.

11. Out of a total of 45 pupae externally sterilized and then either crushed or placed whole in poured malt agar plates, only two developed Trichoderma.

12. Fifty alimentary tracts were dissected from adult beetles and placed on malt agar. None of these have developed Trichoderma although many other organisms appeared to be more or less regularly associated with them.

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(1 All dissections made by Mr. Struble.

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13. Of the numerous other organisms found associated with the adult beetle, one other fungus has produced a similar stain to Trichoderma when inoculated into a white fir tree.

14. All attempts to induce Scolytus ventralis larvae to live in Trichoderma cultures have failed.

There will probably be a preliminary paper prepared by Wright on this project in the fall of 1932.

FURTHER WORK

Because of the fact that one other fungus was found to produce a stain similar to that caused by Trichoderma sp. it will be necessary to prepare pure cultures of this organism and make further inoculation studies.

It appears from the dissection and cultural studies already completed that Trichoderma is carried externally rather than internally by the beetles. It, therefore, seems within the range of possibility to sterilize the beetles externally without killing or seriously injuring them. These sterile beetles can then be permitted to attack sterile logs and observations made later as to the success of brood development. Checks can be run at the same time by allowing sterile beetles to contact Trichoderma cultures before they attack the sterile logs. Since only a small percentage of the pupae carry Trichoderma internally it might also be possible to rear a sufficient number of sterile beetles from pupae kept under sterile conditions and these sterile adults

can be used as described above. This seems to be the most promising land so far secured and such tests will be conducted in the near future.

Other cultural and microscopic studies should also be made in order to clear up a number of minor points, such as whether the mycelium of Trichoderma extends into the bark as well as the wood. If time is available several of the other organisms commonly found associated with the beetles should be studied.

COMPLETION

Indefinite but probably by July 1933.

ASSIGNMENT

Ernest Wright.